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ABSTRACT

The study reported involved: (1) development of a concept learning task which embodied complex concepts similar to those included in elementary school curricula, and (2) investigation of the effects of type of thinking, abstract or concrete; grade levels, fourth, sixth, or eighth; and sex upon performance of human Ss with complex concepts of justice, injustice, freedom, non-freedom, and irrelevant. A pool of subjects was established at each grade level for each category of thinking. The classification of subjects was established by means of a sub-test of the Wechsler Intelligence Scale for children. Materials used were slides. Analysis of variance of the data produced the following results: (1) Subjects classified as abstract thinkers performed significantly better than those classified as concrete thinkers; (2) There was a significant effect for grade level; (3) There was no significant difference found related to sex; and (4) There were no significant interaction effects. Implications for classroom teachers include: (1) Students can deal with concepts that are complex at several grade levels; and (2) The entry level of the student should be considered as an important variable. (CK)

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Concrete and Abstract Thinkers at Three Grade Levels and Their Performance with Complex Concepts

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Some researchers Kagan, Moss, and Sigel (1963) and White (1971) have been concerned with the ways in which Ss make up categories into which the Ss classify elements from a total array of elements. These studies have led to a continuing research effort involving the identification of conceptual styles of Ss. One type of methodology employed is to present the S with a total stimulus array for which the task of the S is to identify several ways of classifying elements of the stimulus array into distinctive categories. The three types of sorts identified by Kagan et al.(1963) were analytic, relational, and inferential concepts while the conceptual style variables identified by White (1971) were inferential, descriptive, and relational. In the early study Kagan et al. (1963) reported that the number of analytic responses of children increased as a function of age and in the later study White (1971) reported an increase in the number of inferential responses as a function of grade level of the S.

Another line of research effort has been to identify Ss with different conceptual styles and compare their performances upon information processing and concept learning tasks. Frederick (1968) and Davis (1967) found in both of their studies that Ss with analytic cognitive styles made significantly fewer errors on concept learning tasks.

The present study was designed to accomplish two purposes. One purpose was to develop a concept learning task which embodied complex concepts similar to the kinds of concepts commonly included in curriculum units presented in

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elementary schools. The other purpose was to investigate the effects of type of thinking, abstract or concrete; grade levels, fourth, sixth, or eighth; and sex, boys or girls upon performance of human Ss with complex concepts of justice, injustice, freedom, non-freedom, and irrelevant.

If the concept task for complex concepts could be developed, it was expected that Ss who were identified as abstract thinkers would perform better than those identified as concrete thinkers and Ss would perform better as a function of increasing grade level.

METHOD

Subjects

A pool of subjects was established at each grade level, fourth, sixth, and eighth, for each category of thinking, namely, abstract and concrete. The classification of subjects was established by means of a sub-test of the Wechsler Intelligence Test for children. Subjects who were classified as abstract or concrete thinkers were then selected at random from each grade level and for each sex for inclusion in the study.

Experimental Material

Early developmental efforts of the concept learning task which incorporated the complex concepts of justice, injustice, freedom, non-freedom, and irrelevant led to the identification of a large pool of exemplars for each of the five conceptual categories. Initially a pool of 78 35 mm slides was established. These 78 slides were then given to a group of three raters to sort into the five categories. All three raters agreed on the classification of 33 slides while two of the three raters agreed on the placement of 29 of the slides. The other sixteen slides were discarded. To the twenty nine slides selected by two of the three raters as identifying the concept, a set of 56 newly developed slides were added.

The original 33 unanimously agreed upon slides and the pool of 86 slides were given a second sorting in which three additional raters were added making a total of six raters for the set of 118 slides.

From this second screening no slide was used which had received agreement from fewer than five of the six raters for the 47 slides finally accepted. From these forty seven slides, the forty which varied most within each category was selected to comprise the set of exemplars for the five complex concepts. In Figure 1 an example of each of the categories is shown.

Insert Fig. 1 about here

Procedures

The Weschler similarities subtest was administered individually according to the procedure recommended in the test manual to each student in the classes selected and scored according to instructions in the manual, in order to screen subjects for the study. Students were assigned at random to Es for testing.

The Slide Sorting Task (SST) was then administered to the 72 subjects selected by class groups which varied in size from one to nine subjects. Presentation procedure was identical for each group with experimenters randomly assigned. Subjects were required to assign each slide of a randomly numbered and randomly assigned sequence to one of five categories: Freedom, Non-Freedom, Justice, Non-Justice, or Irrelevant using a duplicated form supplied by the experimenters. Instructions read to the group were:

> In your school experience you often hear the concepts (or ideas) of justice and freedom or their opposites, non-justice and non-freedom. This study in which you are participating is designed to find out how well students of your grade level understand what is meant by justice and freedom or non-justice and non-freedom.

You will be shown a set of slides that represent these concepts or ideas. When each slide is shown on the screen you are to decide which of these ideas it best represents and mark an X in the column headed by that concept or idea. If a slide picture does not fit any concept or idea, you are to mark an X in the last column."

"Let us try one now."

Project slide A (non-freedom)

Ask: "What category does this slide best fit?"

"Yes, the giraffes in the pen represent the concept of non-freedom and you should place an X under the column marked non-freedom."

"Let's try one more:"

Project slide B (irrelevant)

Ask: "What category does this slide best fit?"

"Yes, the man on the moon's surface does not fit any concept or idea so you should have marked an X in the last column which reads 'Does not fit any concept!"

"Now, a final example:"

Project slide C (justice)

Ask: "What category does this slide best fit?"

"Yes, the picture of the lady weighing her produce purchase represents justice, so you should have marked an X in the column labelled Justice."

"Are there any questions?"

"Now we are ready to see the slides. You will be shown 40 slides and you are to mark the category where each one fits best. You will be given adequate time to decide in which category you wish to place each slide. If you need more time, please raise your hand or speak out. Otherwise, you are not to talk during this study."

Design

The variables under investigation were type of thinker, abstract or concrete; grade level, fourth, sixth, or eighth; and six of S, boy or girl. The dependent variable was the total number of slides correctly classified into all concept categories. Thus the data were

subsequently analyzed using a simple 2 x 3 x 2 ANOVA

RESULTS

The analysis of variance of the data produced the following results:

1. Subjects who were classified as abstract thinkers performed significantly better than subjects classified as concrete thinkers.

2. There was a significant effect for grade level. Subjects performed better as grade levels increased.

3. There was no significant difference found related to the sex of the subject.

4. There were no significant interaction effects.

The F ratios for each of these findings are shown in Table 1.

TABLE 1. Results of ANOVA and F Ratios for Main Effects and Interactions.

Source of Variation	DF	Mean Squares	F Ratio
Grade Level (G)	2	331.43	14.42
Type of Thinker (T)	1	206.72	9.00
Sex of S (S)	1	18.00	<1
G x T	2	21.85	<1
G x S	2	4.29	<1
T x S	1	9.39	<1
G x T x S	2	5.26	<1
Within	60	22.98	
Total	71		

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In Table 2 the means for treatment conditions are shown. Using the data from this table, one can readily calculate that the mean for concrete thinkers is 20.08 compared to abstract thinkers which show a mean of 23.47. The means for the fourth, sixth, and eighth grades are 18.21, 21.50, and 25.62, respectively. Although not significantly different the mean for boys is 21.28 compared to girls where it is 22.28.

TABLE 2. Means for Concrete or Abstract Thinkers by Sex of S at Three Grade Levels.

Grade Level	Fourth		Sixth		Eighth	
Sex of S	B	G	B	G	B	G
Concrete thinker	17.67	17.5	19.67	19.33	23.33	23.00
Abstract Thinker	20.67	17.00	24.17	22.83	28.17	28.00

Discussion

From the results of this study one can observe that efficiency of performance with complex concepts increases as a function grade level and as one might readily expect abstract thinkers perform effectively than concrete thinkers. It was interesting to note that subjects at both levels of concrete and abstract thinkers could be identified at the three grade levels of fourth, sixth, and eighth. According to this study boys and girls perform equally well with complex concepts.

These findings are supportive of the earlier studies of Kagan et al. (1963) and White (1971) in which they reported increases in frequency of analytic responses a function of age and increases in the number of inferential responses as a function of grade level.

Abstract thinkers did significantly better than concrete thinkers and subjects improved on the concept sorting task of complex concepts as a function of grade level.

In a study of word definition in children Al-Issa (1969) reported that there is a gradual development of word definition in children from a low cognitive level to higher level of conceptualization or possibly more simply from a concrete to a more abstract level. Since children in the present study improved significantly from the fourth grade through the eighth grade, the notion of improved ability to handle abstract concepts as a function of development is supported. A reasonable explanation for the superior performance of eighth graders might be that they have an increased cognitive ability to deal successfully with abstract concepts.

Two implications for classroom teachers seem appropriate. One is that students can deal with concepts that are complex at several grade levels although they are more effective at the higher grade levels. The second is that the entry level of the student should be considered as an important variable since abstract thinkers perform more adequately with complex concepts than concrete thinkers. With the trend toward individualized instruction this may be an important consideration for curriculum planning.

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Figure 1. Examples of each concept, Freedom, Justice, Injustice, Non-freedom, or Irrelevant